Space Weather Technical Forecast

Issued on Tuesday, 25 October 2022 at 01:22 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance of R1 Radio blackouts. G1/Minor Storms possible on 28 October.

Analysis of Space Weather Activity over past 24 hours
Solar Activity: Solar activity over the past 24 hours has been Low, with two C-class flares from AR3126 in the southwest quadrant. This region has developed some limited complexity over the last 24 hours, with AR3130 in the southeast also developing weakly. AR3131 close the northeast limb appears to be a weak returning feature, and despite currently appearing benign, will be monitored for further developments and activity. No Earth-directed CME's have been observed in available imagery.

Solar Wind / Geomagnetic Activity: The solar wind, as observed by DSCOVR at L1, started at 500km/s and after peaking at close to 550km/s around 24/0600UTC, has very steadily declined to 490km/s in the regime of the high speed stream from coronal hole 34. Density started just above average, but has slowly declined through the day. Total magnetic field strength started moderate, but soon fell to weak levels. The north-south component, Bz, has varied weakly between positive and negative values. Phi angle was has been predominantly negative (towards the Sun) throughout. Geomagnetic activity was generally Quiet to Unsettled.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) as measured at GOES-16 has remained at background levels. High energy electron flux (greater than 2MeV) at GOES-16 was at normal background levels. The associated 24-hour integrated fluence was well below the Active (1e8 integrated pfu) threshold, with 1.43e6 integrated pfu observed at 24/2400UTC.

Four-Day Space Weather Forecast Summary
Solar Activity: Solar activity is forecast to be mainly Low or Very Low with a chance of M-class flares.

Solar Wind / Geomagnetic Activity: No Earth-directed CMEs have been observed. The high speed stream from coronal hole 34 is expected to average around 500km/s through the first part of 25 October, but then slowly decline to close to background values. An increase is then expected on 28 October as the Earth connects with the high sped stream from coronal hole 36. Geomagnetic activity may start with an isolated risk of Active or G1/Minor Storms, then become mainly Quiet with isolated Unsettled intervals. There is then a further chance of Active or G1/Minor Storm intervals on 28 October as the Earth connects with the high speed stream from coronal hole 36.

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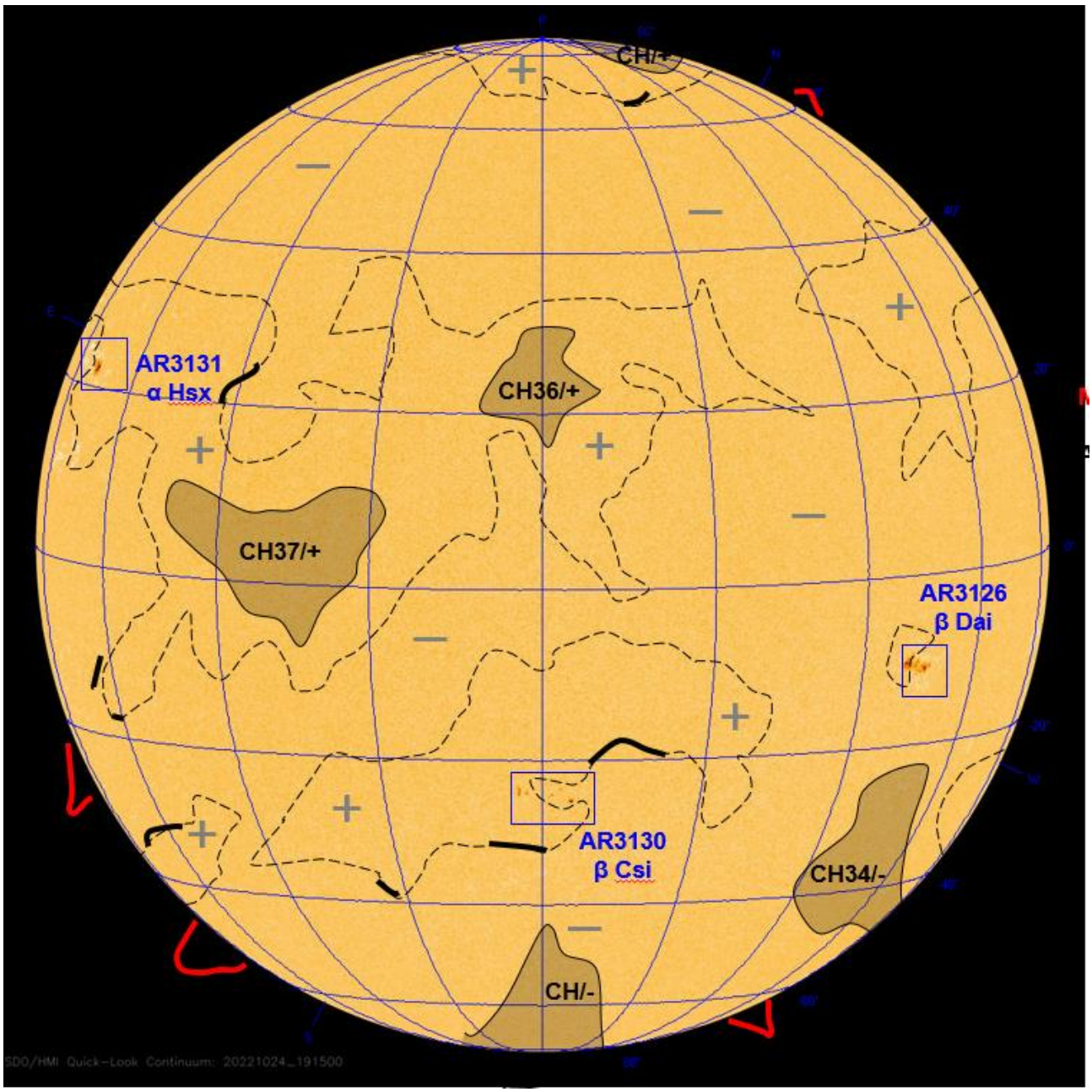
Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10MeV) is expected to be at background. High energy electron flux (greater than 2MeV) is expected to be mainly background to moderate levels at first, but is expected to trend towards mainly high levels through 26 and 27 October as the high speed stream eases. Further reductions are then possible from 28 October due to a further high speed stream and resultant belt compression. Electron fluence values are forecast to begin trending slowly upwards towards the Active threshold from 26 October.

Figure 1. Solar Analysis Valid 24/2000UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

No Earth-directed CMEs are currently forecast.

Earth is currently under the influence of the high speed stream from coronal hole 34, with speed averaging around 500km/s. Connection to this feature is expected to ease through 25 October, with speeds then close to background on 26 and much of 27 October. An increase in speeds are then likely on 28 October as the Earth connects to the high sped stream from recurrent feature coronal hole 36. On the last rotation this feature produced speeds of around 500km/s, and in the absence of STEREO A data, similar speeds are forecast on this occasion. Connection to the high speed stream is forecast for either late on 27 October or more likely during 28 October.

Geomagnetic activity is expected to be mainly Quiet to Unsettled with isolated Active intervals possible at first on 25 October. Mainly Quiet intervals then likely through 26 and 27 October. There is then a chance of Active or G1/Minor Storm intervals on 28 October due to the connection with the next high speed stream, with possible enhancements as this is a positive coronal hole, with this polarity favoured for stronger connections around the September equinox.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	5	1	1	20
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

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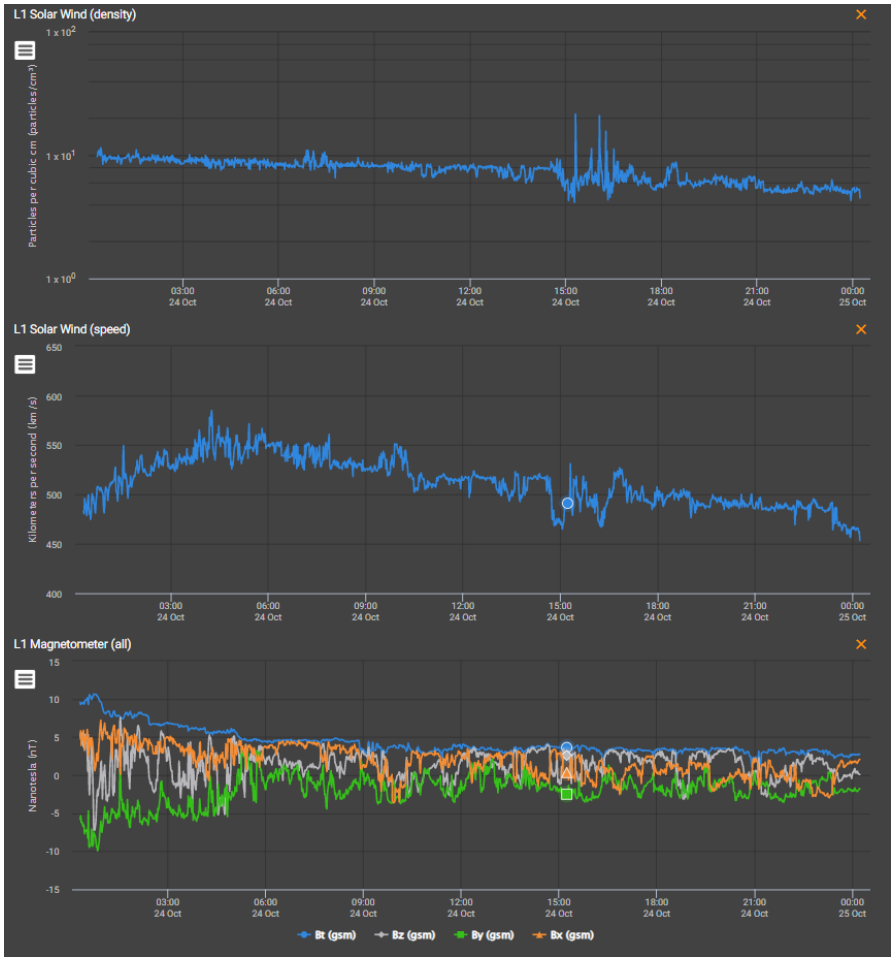
Figure 2: DSCOVR solar wind parameters



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Radio Blackouts - X-Ray Flares:

Solar activity has been Low with three sunspots on the visible disc. All three are developing, with AR3126 and AR3130 the most active, albeit with limited C-class flare activity. AR3131 has recently rotated onto the northeast of the solar disc and despite an initially benign appearance, as a returning feature, potential enhanced activity is considered a possibility.

Low or Very Low activity is expected with a chance of M-class flares, mainly from AR3126 and AR3130.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	20	20	30	30
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 3: GOES-16 X-ray flux

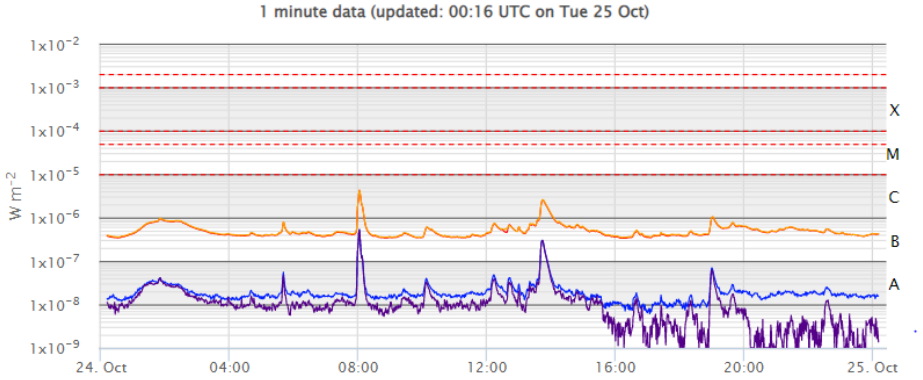
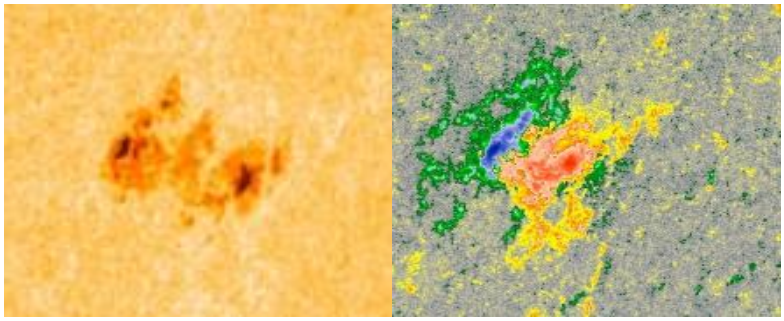


Figure 4: SDO HMI intensitygram and magnetogram imagery of AR3126 (Dai/Beta)



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Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) as observed by GOES16 is currently at background and expected to stay at this level with no significant active regions on the visible disc.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	5	5	5
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

The high energy electron flux (greater than 2MeV) has been close to background levels through the last 24 hours, likely due to the compression exerted on the radiation belts from the current high speed stream. This is likely to be compressing the belts out of their natural orbits, resulting in the measurements observed at GOES-16. As the high speed stream eases, likely on 26 October, electron flux levels are expected to increase towards high levels as the belts relax and electron inputs from the high speed stream become evident. The next high speed stream on 28 October may then have a similar effect of distorting the radiation belts.

Electron fluence values are expected to start increase from 26 October in line with apparent increasing flux levels, with a trend towards the Active (1e8 integrated pfu) threshold by the end of the forecast period.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	20	30	50	50
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	2	5	5

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